

Physics 106c: Electrodynamics

Problem Set 6

Due: 4pm Friday, May 15, 2009

Remember: Late homework will be granted 50% credit up to one week late, unless you have a note from the Dean or a health official.

Reading: Griffiths Chapter 10.

Problems:

1. A long coax is terminated with a 100 picofarad capacitor. The characteristic impedance of the coax is 50 ohms. A square voltage pulse, 1 volt high and 20 ns wide is sent down the coax toward the terminating capacitor. Calculate, numerically if necessary, the shape of the reflected pulse. You may wish to use Fourier analysis for this problem.
2. An infinitely long coax consists of two semi-infinite sections which have 50 ohm characteristic impedances separated by an intermediate section which is 10 cm long and has a characteristic impedance of 93 ohms. Calculate the energy transmission coefficient of this coax as a function of frequency assuming waves are incident from one direction. Describe your results in physical terms.
3. Design a waveguide (with rectangular cross-section) in which the cut-off frequencies of the lowest two propagating modes are 10 GHz and 18 GHz respectively. Give real physical dimensions for the cross-section. Are these modes TE or TM? How many modes of each type propagate in the band from 18 to 22GHz?
4. Consider a hollow waveguide with a right-triangle cross-section. Determine the spectrum of transverse electric (TE) modes which propagate down this guide. In other words, find the ω vs. k relations and cut-off frequencies for the propagating TE modes.

